INTEGRATED CIRCUITS

DATA SHEET

TDA8510J
26 W BTL and 2 × 13 W SE power amplifiers

Preliminary specification
Supersedes data of 1999 Jun 14
File under Integrated Circuits, IC01

1999 Dec 14

Philips
Semiconductors





FEATURES

- Requires very few external components
- High output power
- Low output offset voltage (BTL channel)
- Fixed gain
- Diagnostic facility (distortion, short-circuit and temperature detection)
- Good ripple rejection
- Mode select switch (operating, mute and standby)
- AC and DC short-circuit safe to ground and to V_P
- Low power dissipation in any short-circuit condition
- Thermally protected
- Reverse polarity safe
- Electrostatic discharge protection
- No switch-on/switch-off plop
- Flexible leads
- Low thermal resistance
- Identical inputs (inverting and non-inverting).

GENERAL DESCRIPTION

The TDA8510J is an integrated class-B output amplifier in a 17-lead single-in-line (SIL) power package. It contains a 26 W Bridge-Tied Load (BTL) amplifier and 2 × 13 W Single-Ended (SE) amplifiers.

The device is primarily developed for multi-media applications and active speaker systems (stereo with subwoofer).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
General						
V_P	supply voltage		6	15	18	V
I_{ORM}	repetitive peak output current		–	–	4	A
$I_{q(tot)}$	total quiescent current		–	80	–	mA
I_{stb}	standby current		–	0.1	100	μA
BTL channel						
P_o	output power	R_L = 4 Ω; THD = 10%	–	26	–	W
SVRR	supply voltage ripple rejection		46	–	–	dB
$V_{n(o)}$	noise output voltage	R_s = 0 Ω	–	70	–	μV
$\|Z_i\|$	input impedance		25	–	–	kΩ
$\|\Delta V_{OO}\|$	DC output offset voltage		–	–	150	mV
Single-ended channels						
P_o	output power	THD = 10%				
		R_L = 4 Ω	–	7	–	W
		R_L = 2 Ω	–	13	–	W
SVRR	supply voltage ripple rejection		46	–	–	dB
$V_{n(o)}$	noise output voltage	R_s = 0 Ω	–	50	–	μV
$\|Z_i\|$	input impedance		50	–	–	kΩ

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA8510J	DBS17P	plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm)	SOT243-1

BLOCK DIAGRAM

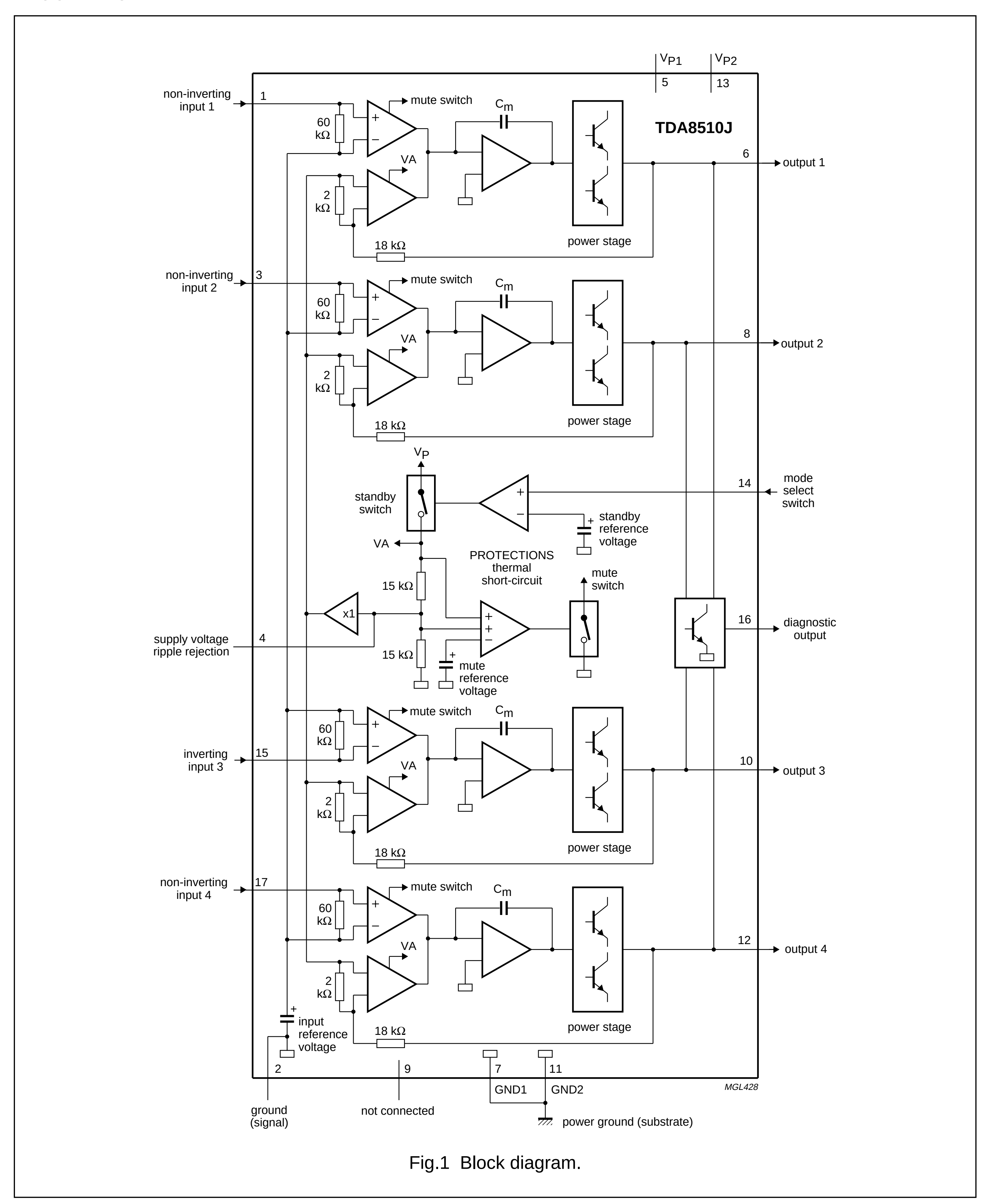


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
–INV1	1	non-inverting input 1
SGND	2	signal ground
–INV2	3	non-inverting input 2
RR	4	supply voltage ripple rejection
V_{P1}	5	supply voltage 1
OUT1	6	output 1
GND1	7	power ground 1
OUT2	8	output 2
n.c.	9	not connected
OUT3	10	output 3
GND2	11	power ground 2
OUT4	12	output 4
V_{P2}	13	supply voltage 2
MODE	14	mode select switch input
INV3	15	inverting input 3
V_{DIAG}	16	diagnostic output
–INV4	17	non-inverting input 4

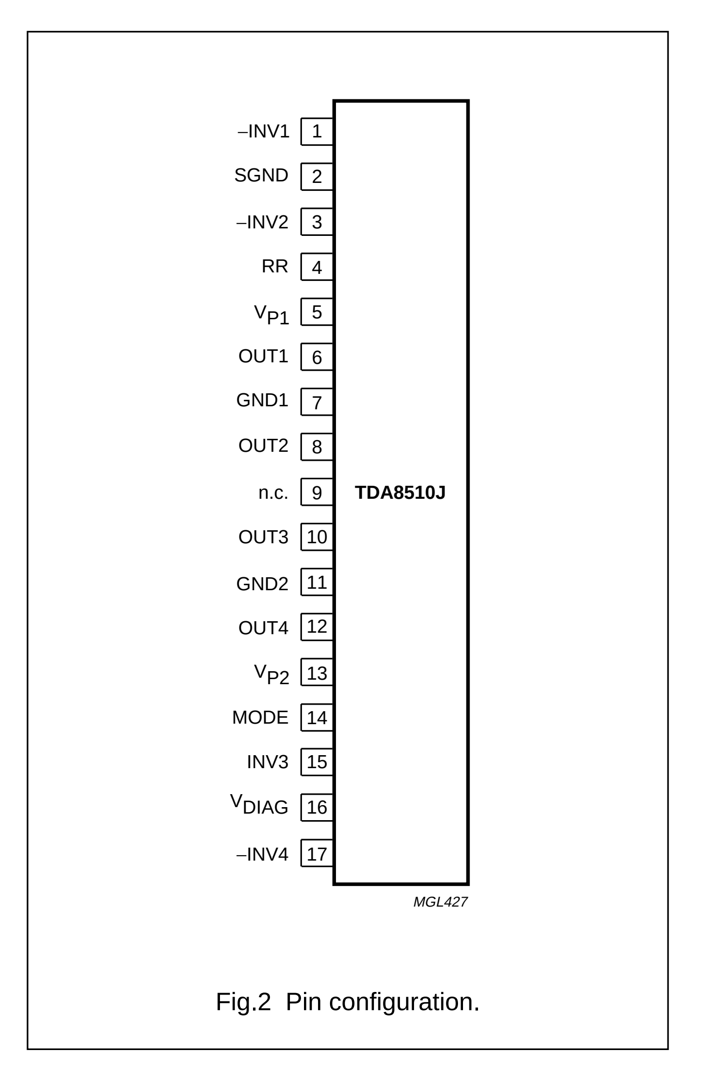


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The TDA8510J contains four identical amplifiers and can be used for two Single-Ended (SE) channels (fixed gain 20 dB) and one Bridge-Tied Load (BTL) channel (fixed gain 26 dB). Special features of the device are:

Mode select switch (pin 14)

- Low standby current (<100 μA)
- Low switching current (low cost supply switch)
- Mute facility.

To avoid switch-on plops, it is advised to keep the amplifier in the mute mode during ≥100 ms (charging of the input capacitors at pins 1, 3, 15 and 17). This can be achieved by:

- Microcontroller control
- External timing circuit (see Fig.8).

Diagnostic output (pin 16)

DYNAMIC DISTORTION DETECTOR (DDD)

At the onset of clipping of one or more output stages, the dynamic distortion detector becomes active and pin 16 goes LOW. This information can be used to drive a sound processor or DC volume control to attenuate the input signal and thus limit the distortion. The output level of pin 16 is independent of the number of channels that are clipping (see Figs 3 and 4).

SHORT-CIRCUIT PROTECTION

When a short-circuit occurs at one or more outputs to ground or to the supply voltage, the output stages are switched off until the short-circuit is removed and the device is switched on again, with a delay of approximately 20 ms, after removal of the short-circuit. During this short-circuit condition, pin 16 is continuously LOW.

When a short-circuit across the load of one or more channels occurs the output stages are switched off for approximately 20 ms. After that time it is checked during approximately 50 μs to see whether the short-circuit is still present. Due to this duty cycle of 50 μs/20 ms the average current consumption during this short-circuit condition is very low (approximately 40 mA).

During this short-circuit condition, pin 16 is LOW for 20 ms and HIGH for 50 μs (see Fig.5).

The power dissipation in any short-circuit condition is very low.

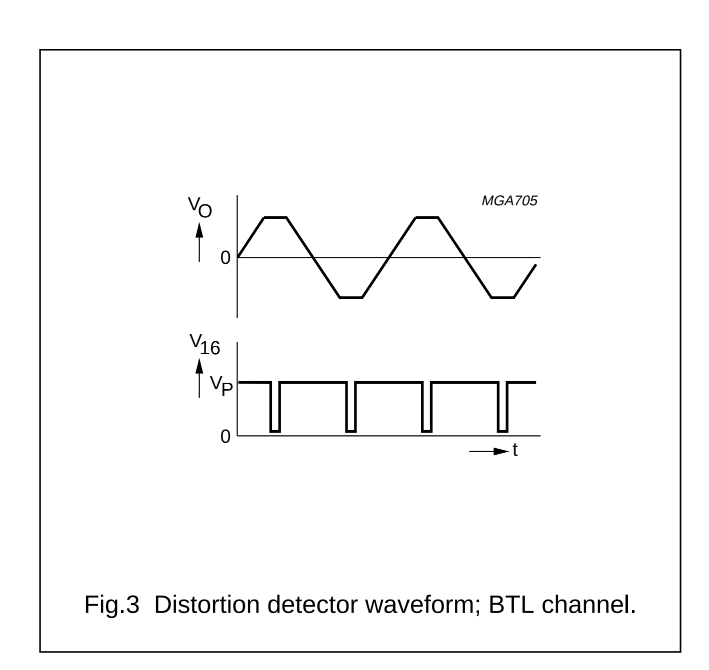


Fig.3 Distortion detector waveform; BTL channel.

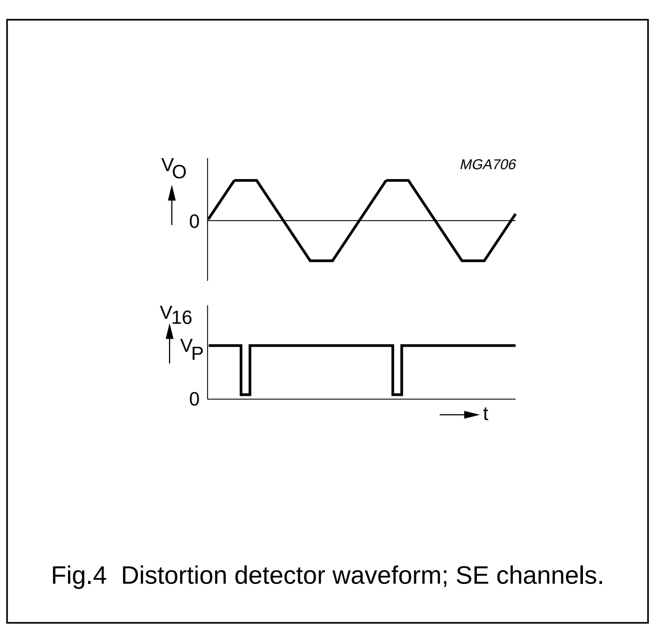


Fig.4 Distortion detector waveform; SE channels.

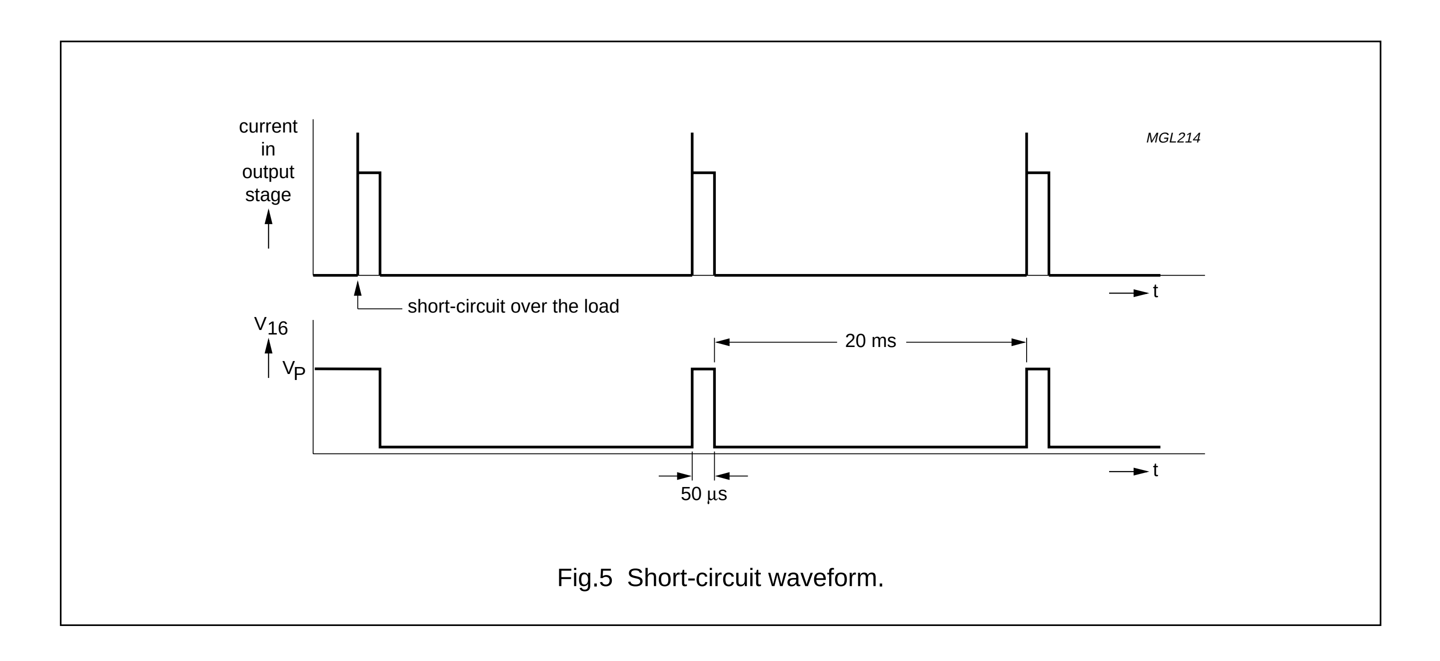


Fig.5 Short-circuit waveform.

TEMPERATURE DETECTION

When the virtual junction temperature T_{vj} reaches 150 °C, pin 16 will be active LOW.

OPEN-COLLECTOR OUTPUT

Pin 16 is an open-collector output, which allows pin 16 of more devices being tied together.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	supply voltage	operating	–	18	V
		no signal	–	20	V
I_{OSM}	non-repetitive peak output current		–	6	A
I_{ORM}	repetitive peak output current		–	4	A
V_{sc}	AC and DC short-circuit safe voltage		–	18	V
V_{rp}	reverse polarity voltage		–	6	V
P_{tot}	total power dissipation		–	60	W
T_{stg}	storage temperature		–55	+150	°C
T_{amb}	operating ambient temperature		–40	+85	°C
T_{vj}	virtual junction temperature		–	150	°C

THERMAL CHARACTERISTICS

In accordance with IEC 747-1.

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	40	K/W
$R_{th(j-c)}$	thermal resistance from junction to case (see Fig.6)		1.3	K/W

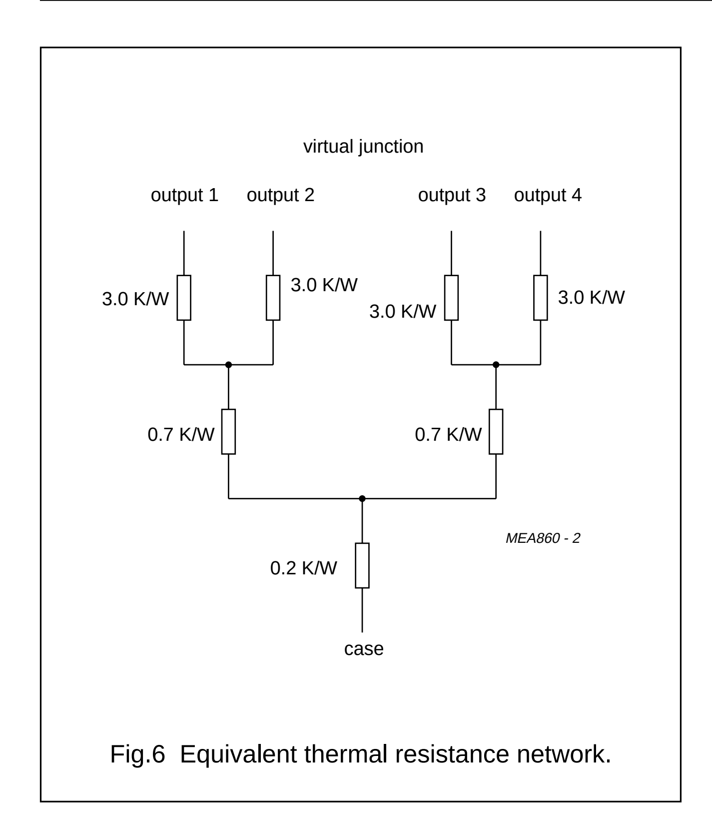


Fig.6 Equivalent thermal resistance network.

DC CHARACTERISTICS

V_P = 15 V; T_{amb} = 25 °C; measured in Fig.7; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	supply voltage	note 1	6	15	18	V
$I_{q(tot)}$	total quiescent current		–	80	160	mA
V_O	DC output voltage		–	6.9	–	V
$\|\Delta V_{OO}\|$	DC output offset voltage	note 2	–	–	150	mV
Mode select switch						
$V_{SW(on)}$	switch-on voltage level		8.5	–	–	V
MUTE CONDITION						
V_{mute}	mute voltage		3.3	–	6.4	V
V_O	output voltage in mute position	$V_{I(max)}$ = 1 V; f = 1 kHz	–	–	2	mV
$\|\Delta V_{OO}\|$	DC output offset voltage	note 2	–	–	150	mV
STANDBY CONDITION						
V_{stb}	standby voltage		0	–	2	V
I_{stb}	standby current		–	–	100	μA
$I_{sw(on)}$	switch-on current		–	12	40	μA
Diagnostic output (pin 16)						
V_{DIAG}	diagnostic output voltage	any short-circuit or clipping	–	–	0.6	V

Notes

1. The circuit is DC adjusted at V_P = 6 to 18 V and AC operating at V_P = 8.5 to 18 V.
2. Only for BTL channel (V_{12-10}).

AC CHARACTERISTICS

V_P = 15 V; f = 1 kHz; T_{amb} = 25 °C; measure in Fig.7; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
BTL channel						
P_o	output power	note 1				
		THD = 0.5%	16	20	–	W
		THD = 10%	22	26	–	W
THD	total harmonic distortion	P_o = 1 W	–	0.06	–	%
B	power bandwidth	THD = 0.5%; P_o = –1 dB; with respect to 16 W	–	20 to 15000	–	Hz
$f_{ro(l)}$	low frequency roll-off	at –1 dB; note 2	–	25	–	Hz
$f_{ro(h)}$	high frequency roll-off	at –1 dB	20	–	–	kHz
G_v	closed loop voltage gain		25	26	27	dB
SVRR	supply voltage ripple rejection	note 3				
		on	48	–	–	dB
		mute	46	–	–	dB
		standby	80	–	–	dB
$\|Z_i\|$	input impedance		25	30	38	kΩ
$V_{n(o)}$	noise output voltage	on; R_S = 0 Ω; note 4	–	70	–	μV
		on; R_S = 10 kΩ; note 4	–	100	200	μV
		mute; notes 4 and 5	–	60	–	μV
α_{cs}	channel separation	R_S = 10 kΩ	40	60	–	dB
DYNAMIC DISTORTION DETECTOR						
THD	total harmonic distortion	$V_{16} \leq 0.6$ V; no short-circuit	–	10	–	%

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Single-ended channels						
P_o	output power	note 1				
		THD = 0.5%	8	10	–	W
		THD = 10%	11	13	–	W
		R_{L1} = 4 Ω; note 1				
		THD = 0.5%	–	5.5	–	W
		THD = 10%	–	7	–	W
THD	total harmonic distortion	P_o = 1 W	–	0.06	–	%
$f_{ro(l)}$	low frequency roll-off	at –1 dB; note 2	–	25	–	Hz
$f_{ro(h)}$	high frequency roll-off	at –1 dB	20	–	–	kHz
G_v	closed loop voltage gain		19	20	21	dB
SVRR	supply voltage ripple rejection	note 3				
		on	48	–	–	dB
		mute	46	–	–	dB
		standby	80	–	–	dB
$\|Z_i\|$	input impedance		50	60	75	kΩ
$V_{n(o)}$	noise output voltage	on; R_s = 0 Ω; note 4	–	50	–	μV
		on; R_s = 10 kΩ; note 4	–	70	100	μV
		mute; notes 4 and 5	–	50	–	μV
α_{cs}	channel separation	R_s = 10 kΩ	40	60	–	dB
$\|\Delta G_v\|$	channel unbalance		–	–	1	dB
DYNAMIC DISTORTION DETECTOR						
THD	total harmonic distortion	$V_{16} \leq 0.6$ V; no short-circuit	–	10	–	%

Notes

1. Output power is measured directly at the output pins of the IC.
2. Frequency response externally fixed.
3. Ripple rejection measured at the output with a source impedance of 0 Ω, maximum ripple amplitude of 2 V (p-p) and at a frequency of between 100 Hz and 10 kHz.
4. Noise measured in a bandwidth of 20 Hz to 20 kHz.
5. Noise output voltage independent of R_s (V_i = 0 V).

TEST AND APPLICATION INFORMATION

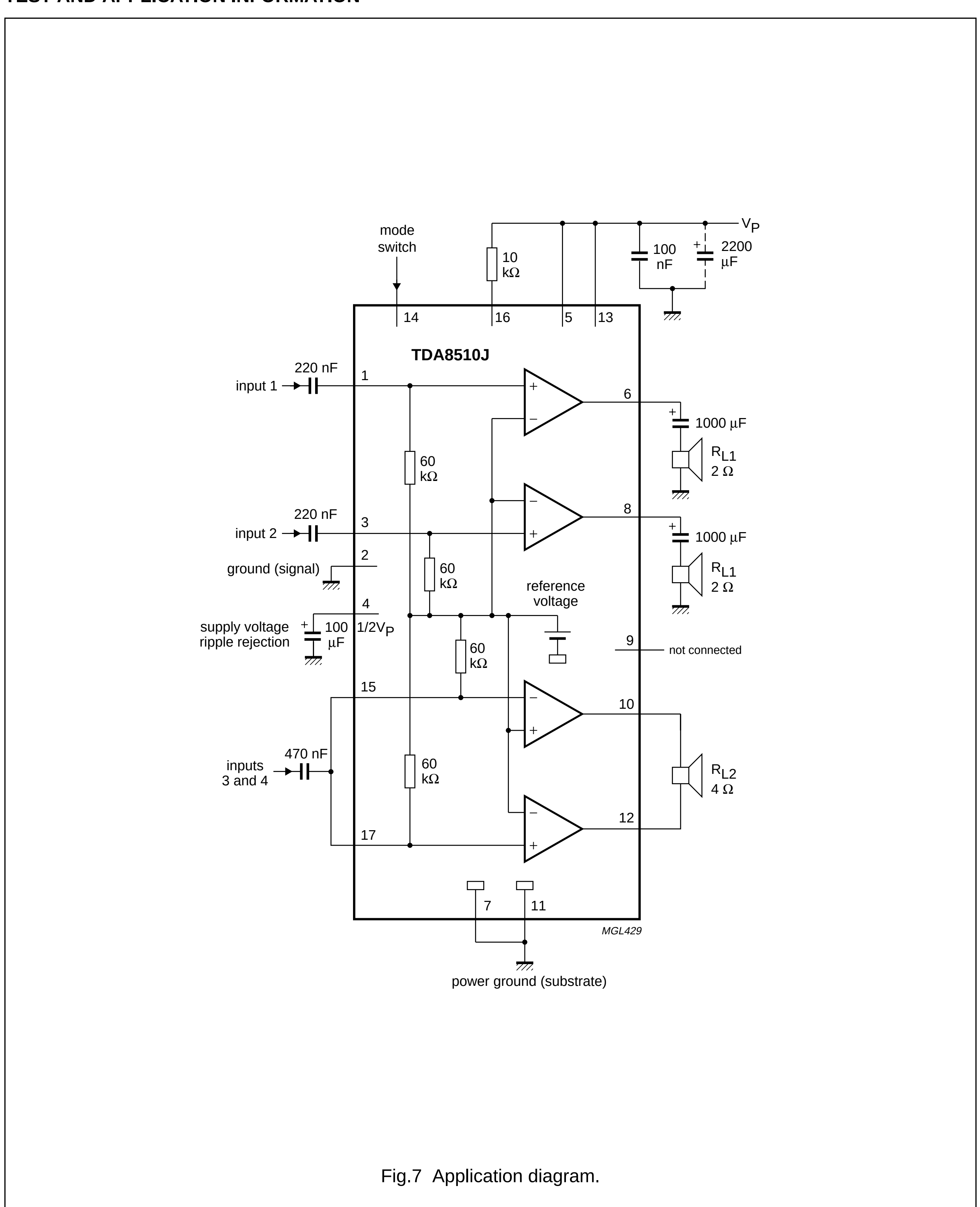


Fig.7 Application diagram.

Mode select switch

To avoid switch-on plops, it is advised to keep the amplifier in the mute mode during >100 ms (charging of the input capacitors at pins 1, 3, 15 and 17.

The circuit in Fig.8 slowly ramps up the voltage at the mode select switch pin when switching on and results in fast muting when switching off.

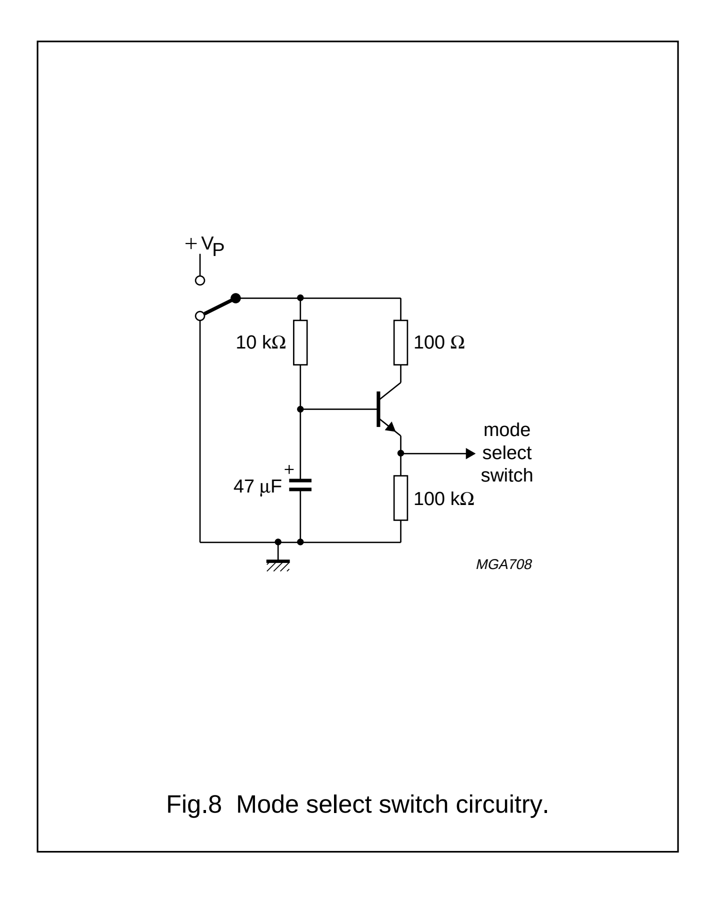
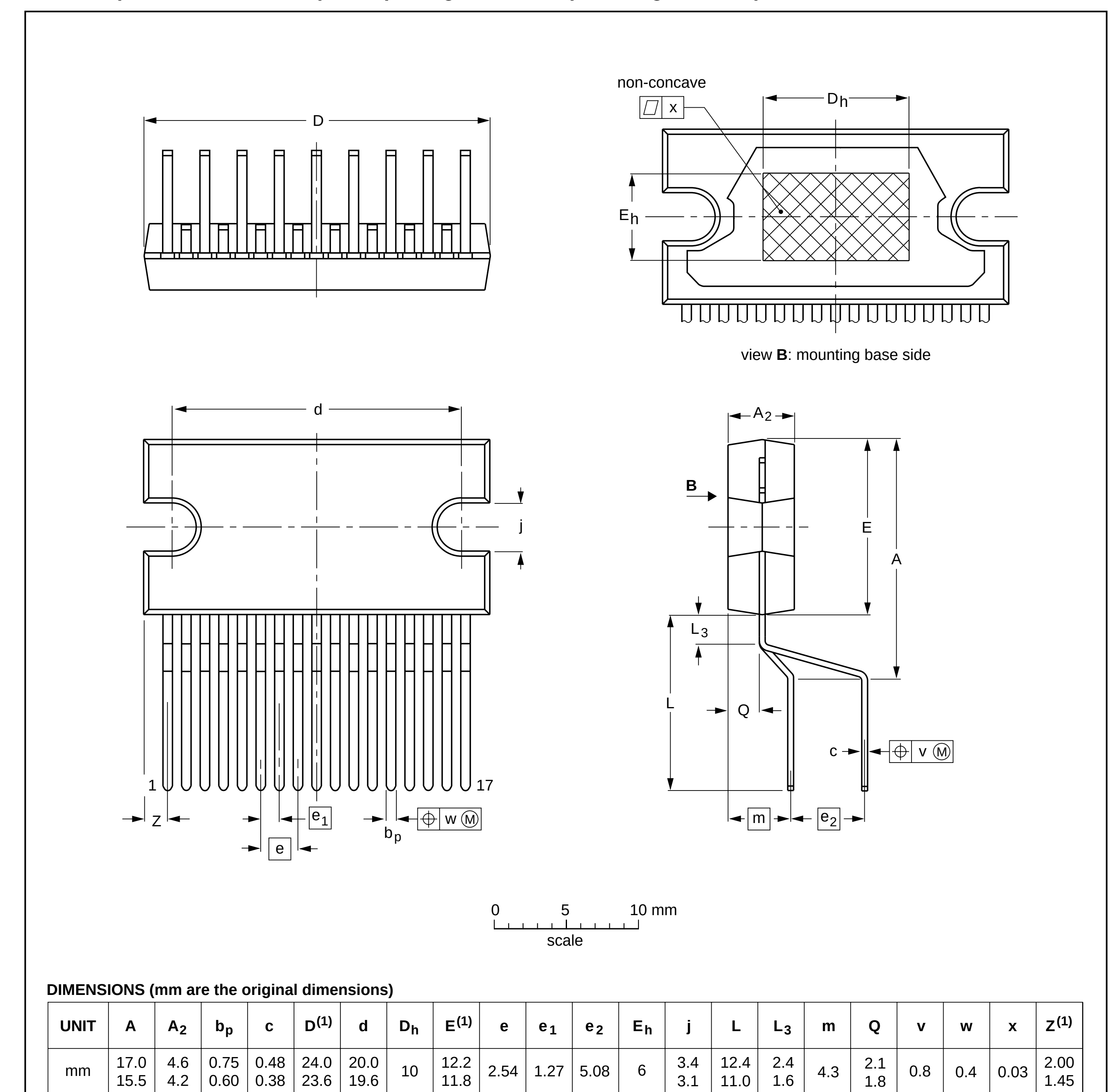


Fig.8 Mode select switch circuitry.

PACKAGE OUTLINE

DBS17P: plastic DIL-bent-SIL power package; 17 leads (lead length 12 mm) **SOT243-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_2	b_p	c	$D^{(1)}$	d	D_h	$E^{(1)}$	e	e_1	e_2	E_h	j	L	L_3	m	Q	v	w	x	$Z^{(1)}$
mm	17.0 15.5	4.6 4.2	0.75 0.60	0.48 0.38	24.0 23.6	20.0 19.6	10	12.2 11.8	2.54	1.27	5.08	6	3.4 3.1	12.4 11.0	2.4 1.6	4.3	2.1 1.8	0.8	0.4	0.03	2.00 1.45

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT243-1						~~95-03-11~~ 97-12-16

SOLDERING

Introduction to soldering through-hole mount packages

This text gives a brief insight to wave, dip and manual soldering. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (document order number 9398 652 90011).

Wave soldering is the preferred method for mounting of through-hole mount IC packages on a printed-circuit board.

Soldering by dipping or by solder wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joints for more than 5 seconds.

The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg(max)}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Manual soldering

Apply the soldering iron (24 V or less) to the lead(s) of the package, either below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

Suitability of through-hole mount IC packages for dipping and wave soldering methods

PACKAGE	SOLDERING METHOD	
	DIPPING	WAVE
DBS, DIP, HDIP, SDIP, SIL	suitable	suitable(1)

Note

1. For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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